



A study on Modular Construction for Industrial Buildings

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ABSTRACT

Modular Construction is a type of pre-engineered, prefabricated construction that primarily uses fabrication of lightweight steel sections and plates to create modular units in a workshop, which are then transported to the site for assembly. Modular construction in Industrial Buildings can be a revolutionary technique to meet production demands with the pace of economic growth.

Keywords: Modular, Pre-engineered, Prefabricated, Industrial, Environment

INTRODUCTION

There is no established date or year for when humans first began using Civil Engineering. However, there are evidence that humans may have begun using Civil Engineering long before, potentially dating back to prehistoric times. During the industrial revolution in the 18th century, high demand for housing and consumer goods led to an exponential increase in the construction activity. It became essential for construction industry to continuously evolve, adding improved techniques and innovative designs to meet humans' demand promptly. One of these Continuous advancements in construction and design is the recent development of Modular construction and design Technique. Looking back to its history, it was in 2014 that a Chinese prefab construction company built a 57-story tower in just 19 days.

Asia's modular miracle

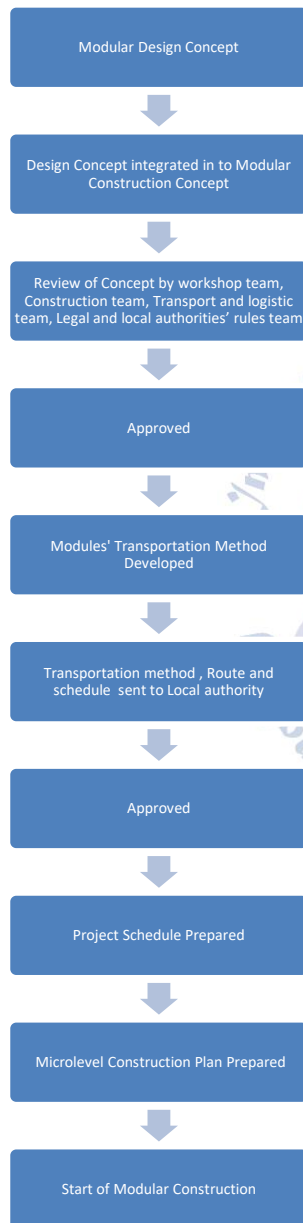


A 230,000-sq m factory in China's Hunan province spent several months producing modules for the 57-story J57 Mini Sky City tower, in Changsha. Using advanced prefabrication techniques, China-based contractor Broad Sustainable Building erected the tower in less than three weeks. Photos courtesy Broad Sustainable Building Company spent 4½ months fabricating 2,736 modules that comprise Mini Sky City's structure,

exterior walls, interiors, and MEP components. It took BSB five months to prepare and complete the building's foundation, and another 30 days to prep the job site and move in cranes, which are critical to a construction process whose goal is to assemble three stories per day.

Source from: <https://www.bdcnetwork.com/asias-modular-miracle>.

STANDARD WORKFLOW AND PROCEDURE BEFORE START OF CONSTRUCTION




The preparation of civil foundations levelled work sites, and vehicular movement paths should be prepared before modular components can be transported to the site. To prevent major storage and construction delays, it is important to match the speed of preparation and installation of modules.


Construction of modules (Offsite / In Workshops)

❖ 2D Modules

1. Wall with Columns at two vertical edges

Components: Steel Columns Sections, Steel beams , Insulating materials, Inner and outer metal sheets.

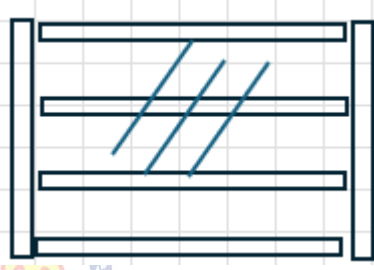
Steel columns say tube: 

Steel beams: 

Wall Insulating material: 

Wall Inner and Outer Sheet: _____

Plan of Wall module: 

Elevation of Wall module: 

2. Roof rafter

Components:

Steel beams: 

3. Roof panel

Components: Beam sections, inner and outer metal sheets, Insulating materials

Steel beams: 

Wall Insulating material: 

Wall Inner and Outer Sheet: _____

Plan of Roof panel : 

Application Example : Industrial Building (Conceptual)

Building Size : 37.5 m x 30.0 m

Floors: G+1

Height: Ground Story – 4.5 m

First Story – 4.5 m

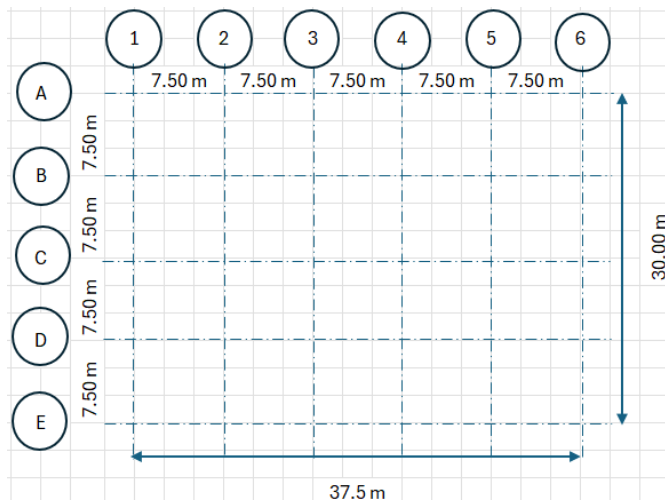


Figure: 1 Grid Layout of Building

Top is roof slab with 1 in 100 pitch to enable adequate roof drainage.

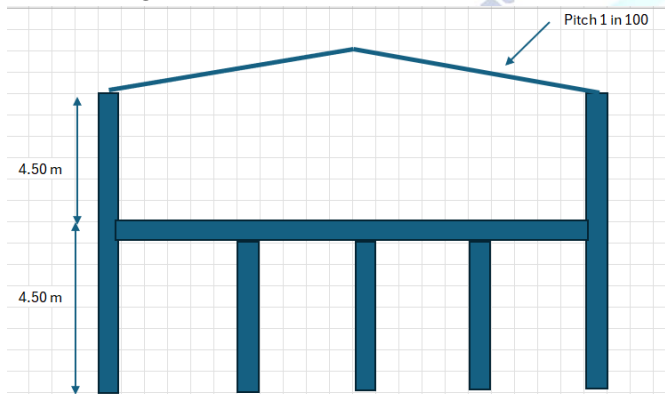


Figure: 2 Section view of Building

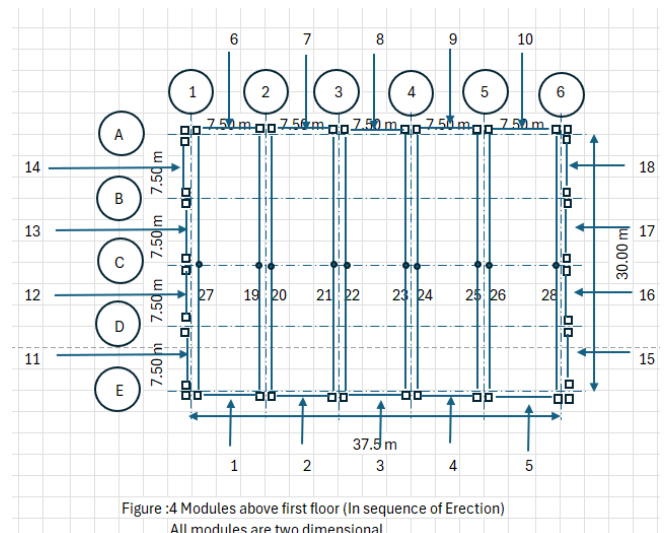


Figure :4 Modules above first floor (In sequence of Erection)
All modules are two dimensional

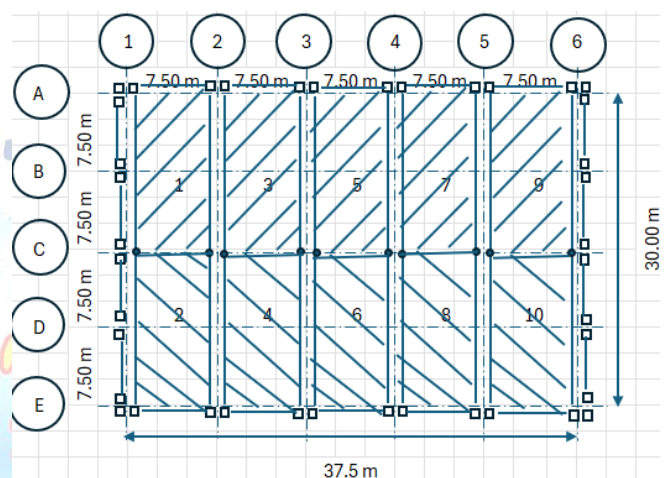


Figure :5 Modules Marking for construction at roof level
(In sequence of Erection)
All modules are two dimensional

Typical 3-D Modules (Offsite / In shops)

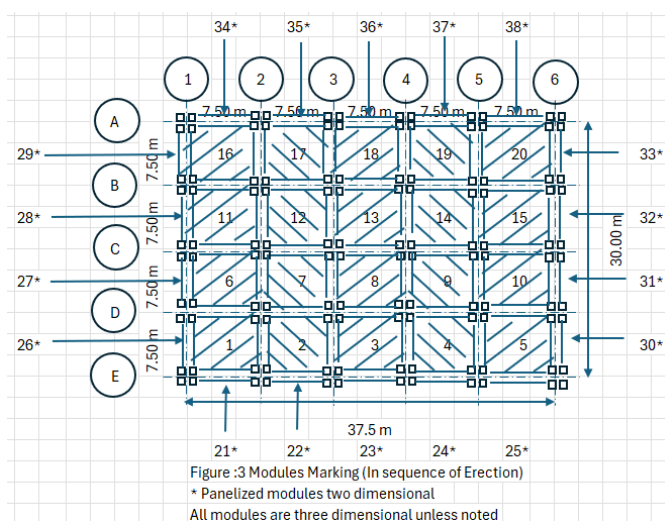
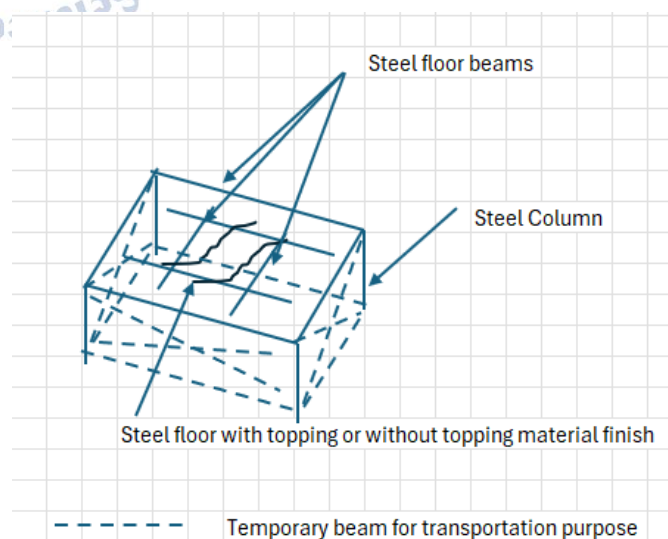


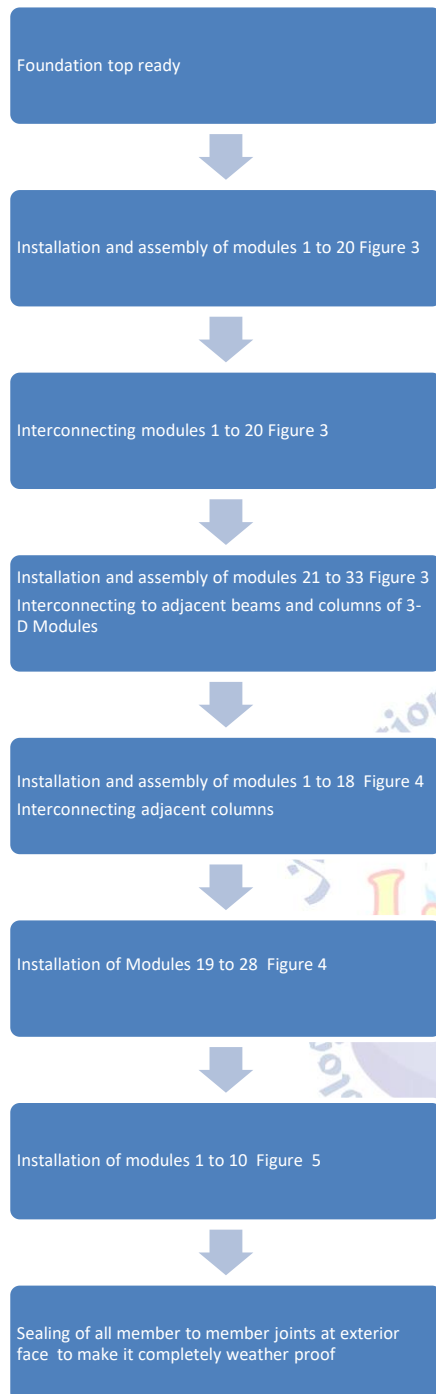
Figure :3 Modules Marking (In sequence of Erection)
* Panelized modules two dimensional
All modules are three dimensional unless noted

(Ground level to First Floor)



In the present examples modules marked 1 to 20 are three dimensional modules.

MODULAR CONSTRUCTION SEQUENCE



Lifting arrangement should be designed so that the lifting forces applied to the module align with its centre of gravity, ensuring that no torsional or coupling forces are generated during lifting.

CONCLUSION

1. Modular construction could be a revolutionary solution for construction of Industrial Buildings, cutting construction time by at least half compared to conventional construction methods.

2. This method can significantly reduce energy consumption, lowering the carbon footprint and benefitting the environment.

3. Furthermore, it produces minimal waste and dust, which decreases its direct impact on pollution.

3. Integration of designs and construction methods is necessary for modular construction to be successful.

4. Due to the bulky and heavy nature of 3D modules, it is necessary to carefully consider and plan for factors such as vehicle configurations, lifting methods, loading and unloading procedures, and modules installation and assembly.

Conflict of interest statement

Authors declare that they do not have any conflict of interest

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